

**THE INTRODUCTION OF ANTIMENINGOCOCCUS SERUM BY
CISTERN PUNCTURE. REPORT OF A CASE OF MENIN-
GOCOCCUS MENINGITIS IN AN INFANT AGED FOUR
MONTHS CURED BY THIS METHOD.***

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As much as the employment of Flexner's serum has helped to reduce the mortality and lessen the number of sequelae in meningococcus meningitis, nevertheless the death-rate is still high and residual injury occurs in a definite percentage of cases. Anyone who has witnessed such end-results of cerebrospinal infection as hydrocephalus, idiocy, paralysis, blindness and deafness will welcome any procedure which offers promise of lessening these consequences of infection in the ventricles and subarachnoid space.

There are several causes for the failure of serum treatment of meningococcus meningitis. Thus the particular strain of meningococcus acting as the infective organism in a given case may not be represented in the serum used; the virulence of the organism may be so great that the serum is of no avail; the serum may be given late in the course of the disease when the destructive processes already present would result in the death of the patient or in permanent brain injury, even though the causative organisms were destroyed. These sources of failure have been pointed out by Ayer.¹ It must be remembered that antimeningococcus serum operates chiefly as a bacteriolytic agent and must be brought into contact with the organisms it is intended to destroy. Herein lies the explanation of many failures of serum treatment.

It would seem, then, that there are three ways by which the treatment of meningococcus meningitis might be improved: (1) By making serum which will be as polyvalent as possible; (2) by administering serum early in the infection; (3) by so introducing serum that it will be brought into better contact with the causative organisms. In this connection it might be well to speak of the fact that serum may be given intravenously. Indeed, it has been claimed that almost 70 per cent of the cases of meningococcus meningitis show evidence of generalized infection and that

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¹ Arch. Neurol. and Psychiat., 1920, 4, 529.

the mortality can be greatly reduced by combining intravenous with intraspinal serum treatment.²

Our concern in this presentation is with the mode of introducing serum into the subarachnoid space. Heretofore there have been two points of entrance to the cerebrospinal system—between the lumbar vertebrae and through the fontanelle into the ventricles. Except for rare accidents, lumbar puncture has been without danger, and serum introduced by this route is curative in many cases. Subarachnoid block and the consequent failure to obtain fluid by lumbar puncture has been the indication for ventricular puncture. Ventricular puncture with the introduction of serum has increased the percentage of cures and also is apparently harmless if properly performed. After the closure of the fontanelle the ventricular point of attack is complicated by the fact that trephining is necessary. Some clinicians have gone so far as to recommend that ventricular puncture and the introduction of serum into the ventricles should be employed as a routine method in infants whenever the diagnosis of meningococcus meningitis is made.³

As has been stated, the chief cause of failure when serum is given in the lumbar region of the spinal cord has been the inability, at times, to bring it into contact with all the infected surfaces of the subarachnoid space. It is in such cases—when the subarachnoid space is blocked by exudate, whether in the spinal canal, the cisternae, the foramina or over the convexity of the brain surface—that ventricular puncture has been indicated and that cistern puncture will also be found of use.

There are reasons why cistern puncture would be a method of choice if it could be shown that it is, if not devoid of danger, at least as safe as lumbar or ventricular puncture. Ayer after performing forty-three punctures in 20 cases believes that it is a harmless procedure if carefully carried out. The greatest amount of exudate in meningitis is often at the base of the brain in the cisternae. It is from adhesions in this region that communicating hydrocephalus develops,^{4,5} and it is probable also that the internal type of hydrocephalus may be caused by the spread of exudate and adhesions from the cisternae into the foramina rather than from the ventricles into the foramina. By injection into the cisternae magnae the serum, in concentrated form, is brought directly into contact with the most infected portion of the subarachnoid space without the necessity of traversing the spinal canal or passing from the ventricles through the foramina and thence into the cisternae. However, while cistern puncture should quickly gain widespread

² Haden, R. L.: *Arch. Int. Med.*, 1919, **24**, 514.

³ Caussade, L. and Remy, A.: *Paris méd.*, 1921, **11**, 129.

⁴ Blackfan, K. D.: *Am. Jour. Dis. Children*, 1919, **29**, 525.

⁵ Dandy, W. E.: *Johns Hopkins Hosp. Bull.*, 1921, **22**, 67.

use as a method of treatment in subarachnoid block, it will not be adopted as a regular route of approach in treating meningitis until its safety and efficacy have been further tested.⁶

The technic as described by Ayer⁷ is as follows: "The patient is placed on the side, as if for lumbar puncture, with the neck moderately flexed. Care is taken to maintain the alignment of the vertebral column to prevent scoliosis and torsion, and in cases in which comparative pressure readings are important the lumbar and cisterna needles should be on the same horizontal plane. After antiseptic preparation of the skin, usually including the shaving of a little hair and local anesthetization with procain, the thumb of the left hand is placed on the spine of the axis and the needle inserted in the midline just above the thumb. The needle may be pushed rapidly through the skin, but should then be cautiously and guardedly forced forward and upward in line with the external auditory meatus and glabella until the dura is pierced.

"If the cisterna be entered at this angle there is usually a distance of from 2.5 to 3 cm. between the dura and the medulla, as shown on frozen sections; with the needle less oblique in position the distance between the walls of the cisterna becomes progressively less. Therefore it is good practice to aim a little higher than the auditory meatus, and if the needle strikes the occiput, to depress just enough to pass the dura at its uppermost attachment to the foramen magnum. At its entrance the same sudden 'give' is felt as in lumbar puncture.

"The needle employed is a regular lumbar puncture needle, nickeloid, 18 gauge preferred, with bevelled stylet, sharp on the sides but not too sharply pointed. There is rather less variation in the depth of the tissue traversed than in the lumbar region, being in an ordinary-sized adult 4 or 5 cm., the greatest distance in the series being 6 cm. and the smallest 3.5 cm. It was found that a faint circular scratch on the needle, 6 cm. from the tip, was entirely satisfactory in judging the distance, and was preferable to the deeper markings of the Patrick needle, which tend to make its insertion a little jerky and consequently less guarded."

In infants and children there are some slight modifications of this technic. Thus the distance from skin to cisterna is somewhat less—being about 2.25 to 3.5 cm., depending on the age of the patient. A needle smaller than 18 gauge may be necessary at times, although a fairly large caliber needle is preferable to allow for the flow of thick and viscid cerebrospinal fluid. It has seemed to us that the "give" of the needle on entering the cisterna magna is greater than that which is experienced in successful lumbar puncture, and one should be cautious not to exert too much

⁶ See discussion of Dr. Ayer's paper in *Arch. Neurol. and Psychiat.*, 1920, 4, 465-469.

⁷ *Loc. cit.*

pressure, lest the sudden entrance of the needle carry it too far in a forward direction.

While cistern puncture has been done on animals^{8 9} and for obtaining material at autopsy for some time, its use in the living human subject has been reported only by Wegeforth,^{10 11} Ayer and Essick. It might be said in passing that the cistern has been drained after trephining at the base of the skull for the relief of meningitis.¹²

We wish to put on record our experience with cistern puncture in a case of meningococcus meningitis. Previous to the employment of cistern puncture in this case we had carried out the procedure on the cadaver with and without the skull-cap removed, and also in several cases of tuberculous meningitis. In this latter condition the usual temporary relief of symptoms of increased intracranial pressure was noted exactly as would occur after lumbar puncture. Since treating the case of meningococcus meningitis, we have used cistern puncture in a case of streptococcus meningitis and also in 2 cases of pneumococcus meningitis, but then only for diagnosis.

CASE REPORT. J. B., Italian, male, aged four months. Admitted to the Children's Hospital of Philadelphia, service of Dr. J. P. Crozer Griffith, March 15, 1921. On admission the infant was partly breast-fed and partly artificially-fed with a cow's milk mixture. Throughout the entire illness this combined feeding was continued.

History of Present Illness. For two weeks prior to admission the patient had been apparently in a febrile state, although the temperature had not been taken to verify this statement of the mother. The baby did not seem very ill until five days before admission, and the fever before this may have been due to a left otitis media, which had been discharging at times for about six weeks. Three days before admission convulsions, described as generalized, began, and these had recurred at frequent intervals since that time. The exact number of convulsions could not be determined, but they were evidently of frequent occurrence, as well as of different grades of severity.

No history of the symptoms other than those enumerated above could be elicited. There had been no vomiting or other gastrointestinal disturbance. The absence of vomiting is to be remarked, since this symptom is one of the earliest and most constant signs of meningitis, being in our experience more frequent than convulsions.¹³ The child seemed drowsy between the convulsive

⁸ Dixon, W. and Halliburton, W.: Jour. Physiol., 1913, 47, 215.

⁹ Weed, L.: Jour. Med. Research, 1914, 31, 21.

¹⁰ Wegeforth, P.: Ayer, J. B. and Essick, C. A.: AM. JOUR. MED. SC., 1919, 157, 789.

¹¹ Loc. cit.

¹² Haynes, I. S.: Arch. Pediat., 1913, 30, 84.

¹³ Mitchell, A. G. and Falkener, W. W.: New York Med. Jour., 1918, 107, 103.

seizures, but nursed from the breast and bottle fairly well. The mother was not intelligent enough to have noted such conditions as hyperesthesia or rigidity. The past medical history, including the details of the patient's birth, was uneventful, the patient having been born at full term by easy labor.

On admission the baby seemed quite sick. The temperature was 101° F., the pulse 150 and the respiration 48. Examination of the heart, lungs and abdomen revealed no abnormal findings. There was, however, marked retraction of the head as well as a positive Kernig sign in both legs and other evidences of cerebrospinal irritation, such as increased knee-jerks, a positive Babinski reflex on both sides and a definite Brudzinski sign. A suggestive tache cérébrale was present. No ankle-clonus could be elicited. Pus was discharging from the left external auditory meatus. The pupils were equal and reacted slightly to light. The fontanelle was not bulging or tense—in fact, there was a slight depression in this region. Lumbar puncture performed at this time was unsuccessful, as fluid was not obtained.

March 16. On this date lumbar puncture resulted in obtaining only 2 cc of a very thick, yellowish fluid which showed the meningococcus in the stained smear, and later the organism was found on culture by Dr. A. G. Waltz. After the removal of the fluid 1 cc of antimeningococcus serum was introduced with difficulty.

March 17. The first convulsive seizure since admission occurred on this date. By lumbar puncture 1.5 cc of thick pus were obtained. After irrigation of the spinal canal with physiologic sodium chloride solution, 1.5 cc of antimeningococcus serum were introduced.

March 18. During all this time the physical findings described on admission were present and the fontanelle remained depressed and under normal tension. Because of the evident subarachnoid block and the absence of a bulging fontanelle it was decided to do cistern puncture rather than ventricular puncture. A needle introduced after the manner described by Ayer at first failed to obtain fluid. A stylet was introduced into the needle. When the stylet was withdrawn it was followed by a long string of material resembling nothing so much as tenacious nasal mucus. Immediately after this a stream of turbid spinal fluid flowed from the needle under considerable pressure; 9 cc of this fluid were removed and 6 cc of antimeningococcus serum were then slowly introduced. The specimen obtained by cistern puncture showed the meningococcus on smear and culture; contained albumin and globulin in large amount; had 2900 cells to the cm. and did not reduce boiling copper solution.

March 19. Lumbar puncture was not successful in obtaining fluid. By cistern puncture 17 cc of turbid fluid were removed under marked pressure; 5 cc of serum were introduced. A few

hours after the cistern puncture the patient had convulsive twitchings of the face and extremities.

March 20. Twelve cc of cloudy fluid were obtained by cistern puncture and 8 cc of serum were introduced.

March 21. Rigidity was still present, although not as marked as on admission. The fontanelle continued to be slightly depressed. Vomiting of a projectile character occurred for the first and only time while the child was under observation. On this date also it was noticed that the sclera of the left eye was injected. Subsequently the left eye developed panophthalmitis. Permission to remove the eye was refused and the condition eventually subsided with a subsequent atrophy—the right eye fortunately remaining normal. (The eye had been examined and treated by Dr. H. M. Langdon and Dr. A. R. Renniger.)

March 22. Eight cc of almost clear fluid were obtained by cistern puncture and 6 cc of serum were introduced. No meningococci were found in this fluid.

March 24. On this date it was decided to try lumbar puncture again, with the result that 7 cc of somewhat blood-tinged fluid were obtained under slightly increased pressure. No serum was given. A cistern puncture was then done. After the removal of 2 cc of clear fluid, which did not seem to be under increased pressure, the patient suddenly became shocked—the respiration ceasing for almost fifty seconds and the pulse being practically imperceptible. The needle was immediately withdrawn and the return to a normal pulse and respiratory rate was rapid.

March 26. Six cc of clear fluid under normal pressure were obtained by lumbar puncture. No serum was given. No meningococci were found.

April 15. By this time the baby's general condition had greatly improved. There was still slight rigidity of the neck, but other signs of cerebrospinal irritation were not present. No puncture had been performed since the one in the lumbar region on March 26.

April 26. The patient was discharged on this date, cured of meningococcus meningitis. There was atrophy of the left eye and a shrunken condition of the tissues of the orbit.

Six months after discharge from the hospital, the patient was seen and examined. With the exception of the atrophy of the left eye the cure was apparently complete and no evidence of cerebrospinal irritation, optic atrophy, hydrocephalus or paralysis could be found.

We have reported this case because we desire to call attention to the applicability of cistern puncture to infants, and because, as far as we have been able to ascertain, this is the first case of subarachnoid block due to the meningococcus which has been cured by cistern puncture.